

CLAIMS

1. A protection system of the battery of a vehicle, the vehicle having a motor, an ignition system (MA) of the motor, a battery (BA) used by the ignition system (MA) in order to start the motor, an alternator (AL) actuated by the motor in order to recharge the battery (BA) and at least an electric load (CS) supplied by the battery (BA), the protection system comprising a device (1) for electrically disconnecting or connecting the battery (BA) with respect to the electric load (CS), the device (1) having
 - 5 - switch means (20, 21, 22) connected in series between the battery (BA) and the electric load (CS) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated in order to displace the movable contact (21),
 - 10 - a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) being representative of the state of charge of the battery (BA), comparator means for operating a comparison between the measured value of the electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) as a function of the comparison performed by the comparator means, characterized in that
 - 15 - the control circuit (15) further comprises means for detecting the ambient temperature (TEMP), means for detecting the time of inactivity of the motor (E_OFF), means for calculating a mean value of voltage (VB_AVG) of the battery,
 - 20 - the electrical quantity (V_BATT, VB_AVG) is the mean value of voltage of the battery (BA),
 - 25 - the threshold value (VTH) is variable in function of the ambient temperature (TEMP) and the time of inactivity of the motor (E_OFF),
 - 25 - the actuation means comprise a bistable electromagnetic arrangement (20, 21, 22) capable of passing from a first stable condition to a second stable condition following a pulse generated by the control means.
- 30 2. System according to claim 1, characterized in that the control circuit (15) comprises means for detecting the battery voltage (V_BATT).
- 35 3. System according to claim 2, characterized in that the control circuit (15)

comprises means for cyclically detecting a difference of voltage at the ends of movable contact (21).

4. System according to claim 1, characterized in that the control circuit (15) comprises means for acquiring or detecting a first signal being indicative of an active condition of the alternator (AL).

5. System according to claim 1, characterized in that the control circuit (15) comprises means for acquiring or detecting a second signal being indicative of an active condition of the ignition system.

10. System according to claims 4 and 5, characterized in that the control circuit (15) is operative for causing in an automatic way closure of the switch means (20, 21, 22) in case the difference of voltage at the ends of the movable contact (21) exceeds a predefined value for a certain number of successive detections and the first and the second signal are simultaneously present.

15. System according to claim 1, characterized in that the control circuit (15) comprises means for verifying the occurrence of a plurality of predetermined conditions and that the control circuit (15) is operative for causing in an automatic way the switch means (20, 21, 22) to open in case the mean voltage (VB_AVG) is lower than the threshold value and, at the same time, said plurality of predetermined conditions occurs.

20. System according to claim 7, characterized in that said predetermined conditions are selected in the group comprising at least the following: ignition system not active, in particular lack of insertion of an ignition key, alternator not active, vehicle's emergency lamps not active, lack of opening of vehicle's doors, lack of actuation of a vehicle's brake, lack of activation of vehicle's remote control devices.

25. System according to claim 1, characterized in that the control circuit (15) comprises means for measuring the internal resistance of the battery (BA), comprising in particular a low ohmnic value resistor and an electronic switch, in particular a solid state relay.

30. System according to claim 1, characterized in that the device (1) integrates, or is connected to, a crash sensor.

11. System according to claim 1, characterized in that the device (1) integrates one or more fuses.

35. System according to claim 1, characterized in that the device (1) comprises a serial interface, in particular of CAN or LIN type, for the connection

of the control circuit (15) to an external electronic apparatus, the latter being in particular provided for

- receiving information detected by means of the control circuit (15) and/or
- sending information or configuration data to the control circuit (15).

5 13. System according to claim 1, characterized in that the control circuit (15) comprises means for measuring the current distributed by the battery (BA), said means comprising in particular a Hall effect current sensor.

14. System according to claim 1, characterized in that the bistable electromagnetic arrangement (20, 21, 22) comprises

10 - an electromagnet (20), having an inductor winding (20A) provided with a magnetic yoke (20B), the ends of the winding (20A) being electrically connected to the control circuit (15);

 - a movable armature (20C), susceptible of being displaced in two opposite directions as a function of the polarity of excitation of the electromagnet (20);

15 - an elastic element (22), operative for pushing the armature (20C) in a first position;

 - a permanent magnet (20D), susceptible of attracting the armature (20C) in order to maintain it in a second position against the action of the elastic element (22).

20 15. System according to claim 14, characterized in that the movable contact (21) is maintained in the closed position by means of the elastic element (22) and in the open position by means of the permanent magnet (22D), and that it is operatively associated to the armature (20C).

25 16. System according to claim 14 or 15, characterized in that the armature is configured as a core (20C) capable of linear movement.

 17. System according to claim 15 or 16, characterized in that the movable contact (21) is supported by the armature (20C) with movement capability with respect to the latter.

30 18. System according to claim 14 or 15, characterized in that the armature is configured as an anchor capable of angular movement.

 19. System according to claim 1, characterized in that the device (1) comprises a casing realized by at least two parts (2, 3) mutually coupled in a sealed way, within which the bistable electromagnetic arrangement (20, 21, 22) is housed.

35 20. System according to claim 1, characterized in that the device (1)

comprises a casing realized by at least two parts (2, 3) mutually coupled in a sealed way, within which the control circuit (15) is housed.

21. System according to claim 19 or 20, characterized in that a covering element (5) is associated to the casing (2, 3), for two terminals (T1, T2) for the connection of the device (1), the covering element (5) comprising a hooking part (6) and a closing part (7), mutually joined by means of an elastically deformable portion (8), acting as a hinge.

22. System according to claim 1, characterized in that the device (1) comprises manually actuated commutation means (12) being operatively associated to the control circuit (15) and provided for manually controlling, should the need arise, the passage of the movable contact (21) from a respective first position to a respective second position, or vice versa.

23. System according to claim 19 or 20, characterized in that a vent device (14-14D) is associated to the casing (2, 3), operative for avoiding significant increases of pressure within the casing itself.

24. System according to claim 23, characterized in that the vent device (14-14D) comprises a membrane (14B) of a material being permeable to air and impermeable to water and humidity.

25. System according to claim 19, characterized in that the control circuit (15) is at least partly mounted on a board having a plurality of through-holes (15A), some of said holes being designed for receiving the ends of respective positioning pins (16) which rise from the casing (2,3), and some others of said holes being designed for cooperating with fixing means (17) in order to fasten the board to the casing (2, 3).

26. System according to claim 1, characterized in that the device (1) comprises two connection terminals (T1, T2) connected to the control circuit through respective connection elements made of electrically conductive material (24, 25), which are at least in part wrapped by material constituting the casing (2, 3).

27. System according to claim 26, characterized in that each connection element (24, 25) is obtained by a shaped metallic strap or small bar.

28. System according to claim 27, characterized in that each connection element (24, 25) comprises a first end portion (26) to which a respective terminal (T1, T2) is fixed, a second end portion (27) for the connection to the control circuit (15), a median portion (28) that extends between the end portions (26, 27),

an intermediate contact portion (29) capable of cooperating with the movable contact (21).

29. System according to claim 27, characterized in that the median portion (28) is at least partially surrounded by material constituting a wall of the casing
5 (2).

30. System according to claim 28, characterized in that at least a part (28A) of the median portion (28) has recesses or projections (28B) defining a labyrinth apt for cooperating with said material in order to eliminate possible water and humidity infiltrations towards the inside of the casing (2, 3).

10 31. System according to claim 30, characterized in that a thermoplastic material is molded with or over said part (28A), which is in turn wrapped by material constituting said wall of the casing (2, 3).

15 32. System according to claim 1, characterized in that the device (1) comprises two connection terminals (T1, T2), to at least one of which there is electrically associated a conductor (30) having at least a portion protruding outside the casing (2), to realize a "jump start" contact, i.e., a fixing point for a clamp of an electric cable for the connection to an auxiliary starting system of the vehicle.

20 33. System according to claims 21 and 32, characterized in that said portion passes through an aperture (6B) of the covering element (5) for being accessible when the latter is in a respective open position.

34. A device (1) for electrically connecting and/or disconnecting the battery (BA) of a vehicle with respect to an electric load (CS) of the vehicle, the device (1) having

25 - a casing (2,3),
- two terminals (T1, T2) for connecting the device (1) in series between the battery (BA) and the electric load (CS),

30 - switch means (20, 21, 22) operatively interposed between the two terminals (T1, T2) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated for displacing the movable contact (21),

35 - a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) being representative of the state of charge of the battery (BA), comparator means for performing a comparison between the measured value of the electrical quantity (V_BATT,

VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) in function of the comparison operated by the comparator means,

characterized in that a conductor (30) is associated to the terminal (T1)
 5 which is provided for being connected to the positive polarity of the battery (BA),
 the conductor (30) having at least one portion protruding outside the casing (2, 3),
 to realize a "jump start" contact, i.e., a fixing point for a clamp of an electric cable
 for the connection to an auxiliary starting system of the vehicle.

35. Device according to claim 34, characterized in that a covering element
 10 (5) is associated to the casing (2, 3) for the two terminals (T1, T2) and the
 conductor (30), the covering element (5) comprising a hooking part (6) and a
 closing part (7), mutually joined by means of an elastically deformable portion
 (8), acting as a hinge.

36. Device according to claim 35, characterized in that said portion of the
 15 conductor (30) passes in a passage (6B) of the covering element (5) for being
 directly accessible when the latter is in a respective open position.

37. A device (1) for electrically connecting and/or disconnecting the battery
 (BA) of a vehicle with respect to an electric load (CS) of the vehicle, the device
 (1) having

20 - a casing (2,3) made of at least two parts (2, 3) mutually coupled in a sealed
 way,

- two terminals (T1, T2) for connecting the device in series between the
 battery (BA) and the electric load (CS),

25 - switch means (20, 21, 22) operatively interposed between the two
 terminals (T1, T2) and capable of assuming a closed condition and an open
 condition, the switch means comprising a movable contact (21) and actuation
 means (20, 22) which can be actuated in order to displace the movable contact
 (21),

30 - a microprocessor control circuit (15), comprising means for measuring at
 least one electrical quantity (V_BATT, VB_AVG) representative of the state of
 charge of the battery (BA), comparator means for performing a comparison
 between the measured value of the electrical quantity (V_BATT, VB_AVG) and
 a respective threshold value (VTH), control means capable of controlling the
 actuation means (20, 22) in function of the comparison operated by the
 35 comparator means, characterized in that a vent device (14-14D) is associated to

the casing (2, 3), operative for avoiding significant increases of pressure within the casing itself.

38. Device according to claim 37, characterized in that the vent device (14-14D) comprises a membrane (14B) made of a material which is permeable to air
5 and impermeable to water and humidity.

39. A device (1) for electrically connecting and/or disconnecting the battery (BA) of a vehicle with respect to an electric load (CS) of the vehicle, the device (1) having

- a sealed casing (2,3),
10 - two terminals (T1, T2) for connecting the device in series between the battery (BA) and the electric load (CS),

- switch means (20, 21, 22) operatively interposed between the two terminals (T1, T2) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation
15 means (20, 22) which can be actuated in order to displace the movable contact (21),

- a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) representative of the state of charge of the battery (BA), comparator means for performing a comparison
20 between the measured value of the electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) in function of the comparison operated by the comparator means,

characterized in that the terminals (T1, T2) are connected to the control
25 circuit (15) by means of respective connection elements made of conductive material (24, 25), wherein at least a part (28) of the connection elements (24, 25) that it is surrounded by material constituting the casing (2,3) has recesses and/or projections (28B) defining a labyrinth aimed at eliminating possible water and humidity infiltrations towards the inside of the casing (2, 3).

30 40. Device according to claim 39, characterized in that a thermoplastic material is molded with or over said part (28A), which is in turn wrapped by material constituting the casing (2, 3).

41. System according to claim 39, characterized in that each connection element (24, 25) comprises

35 - a first end portion (26) to which a respective terminal (T1, T2) is fixed,

- a second end portion (27) for the connection to the control circuit (15),
- a median portion (28) that extends between the end portions (26, 27),
- an intermediate contact portion (29) capable of cooperating with the movable contact (21).

5 42. A protection system of the battery of a vehicle, the vehicle having a motor, an ignition system (MA) of the motor, a battery (BA) used by the ignition system (MA) in order to start the motor, an alternator (AL) actuated by the motor in order to recharge the battery (BA) and at least an electric load (CS) supplied by the battery (BA), the protection system comprising a device (1) for electrically
10 disconnecting or connecting the battery (BA) with respect to the electric load (CS), the device (1) having

15 - switch means (20, 21, 22) connected in series between the battery (BA) and the electric load (CS) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated in order to displace the movable contact (21),

20 - a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_{BATT} , VB_{AVG}) being representative of the state of charge of the battery (BA), comparator means for operating a comparison between the measured value of the electrical quantity (V_{BATT} , VB_{AVG}) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) as a function of the comparison performed by the comparator means, the control circuit (15) further comprising means for detecting a first signal being indicative of an active condition of the alternator (AL) and
25 means for detecting a second signal being indicative of an active condition of the ignition system,

30 wherein the control circuit (15) is operative for causing in an automatic way closure of the switch means (20, 21, 22) in case the difference of voltage at the ends of the movable contact (21) exceeds a predefined value for a certain number of successive detections and the first and the second signal are simultaneously present.